

## Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project at Slick Rock, Colorado

*This fact sheet provides information about the UMTRA Ground Water Project sites at Slick Rock, Colorado. The U.S. Department of Energy Grand Junction Office in Grand Junction, Colorado, manages the UMTRA Ground Water Project.*

### Site Description and History

The Slick Rock UMTRA Ground Water Project sites consists of two former uranium ore-processing facilities located in a remote area of southwest Colorado about 22 miles north of the town of Dove Creek in San Miguel County (Figure 1). These sites, referred to as the North Continent and Union Carbide sites, are located adjacent to the Dolores River. The Union Carbide site is approximately 1 mile downstream of the North Continent site (Figure 2).

The Shattuck Chemical Company constructed the North Continent mill in 1931. In 1934, North Continent Mines, Inc., acquired the facility. The mill was designed to extract vanadium and radium salts from locally mined ores. In 1945, the Federal Government acquired control of the facility through the Union Mines Development Corporation with the specific purpose of supplying uranium for the Manhattan Project. Union Carbide became the owner of the facility in 1957. The North Continent site is currently owned by UMETCO/Dow Chemical Corporation.

The Union Carbide mill began operation in 1957 using a uranium-vanadium upgrading technique to process ore mined from the surrounding area. The upgraded material was shipped to the Union Carbide mill at Rifle, Colorado, for further processing. The Union Carbide mill at Slick Rock closed in December 1962. The Union Carbide site is currently owned by UMETCO/Dow Chemical Corporation.

The U.S. Department of Energy (DOE) completed surface remediation with the removal of approximately 1 million tons of tailings and other contaminated materials at these sites. The contaminated materials were relocated to an engineered disposal cell approximately 5 miles east of the Slick Rock former ore-processing facilities. Surface remediation began in 1995 and was completed in 1996. The former processing facilities have been regraded with on-site material and reseeded.

According to federal regulations established in the Uranium Mill Tailings Radiation Control Act (42 United

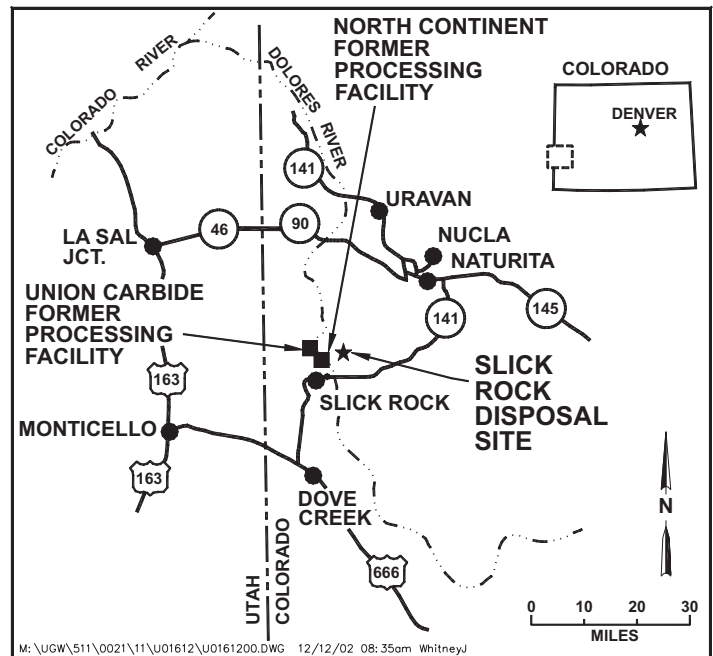
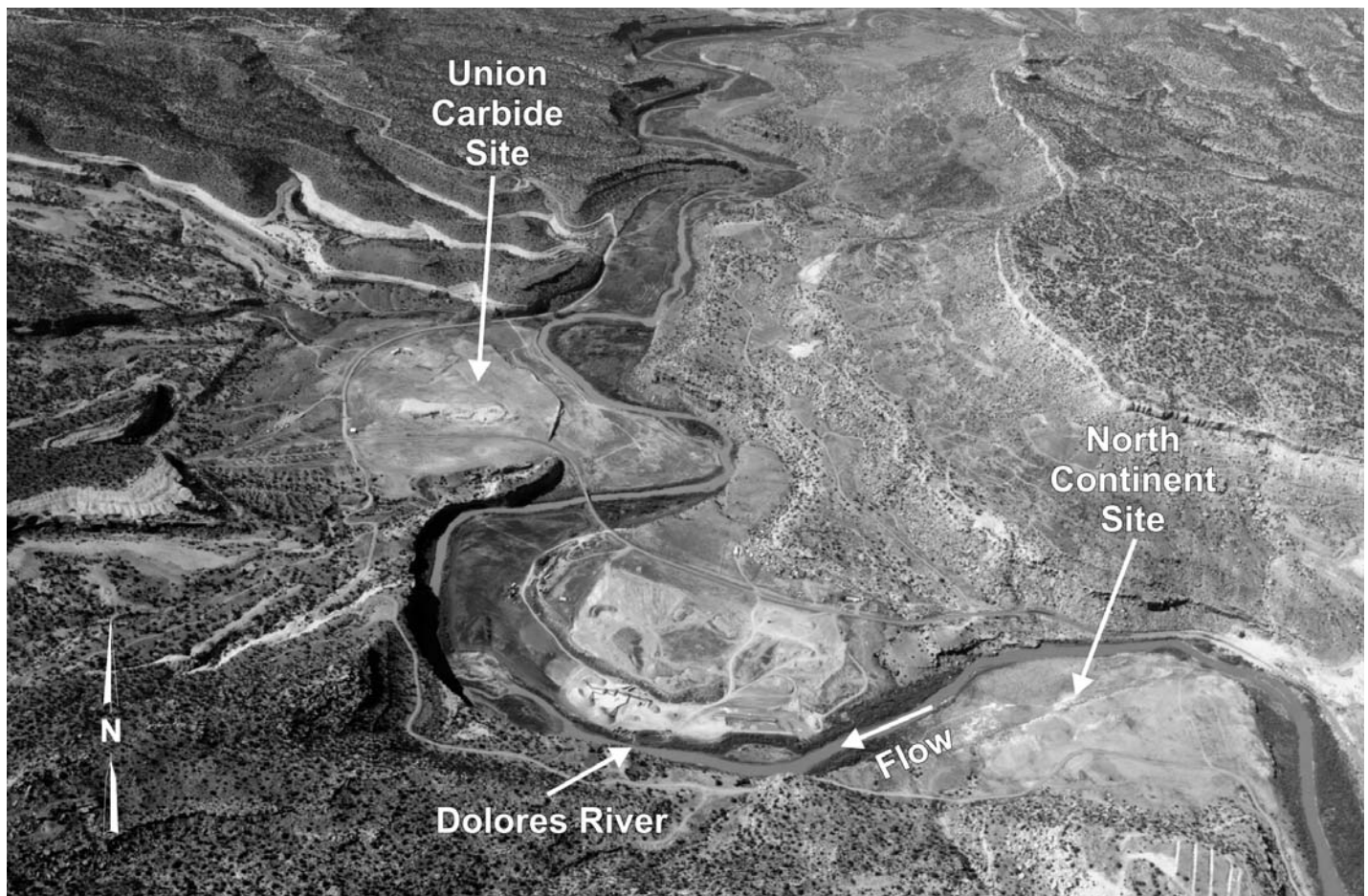


Figure 1. Location of the Slick Rock UMTRA Ground Water Project Sites

States Code 7901 et seq.) and the U.S. Environmental Protection Agency's (EPA's) standard set forth in Title 40 Code of Federal Regulations Part 192, ground water in the uppermost aquifer at the respective sites must be cleaned up to the applicable standards.

The alluvial aquifer is within the canyon and terrace walls of the Dolores River valley. At the Slick Rock sites, the alluvial aquifer is the upper most aquifer. Alluvium is a general term for clay, silt, sand, gravel, or similar unconsolidated material that has been deposited during comparatively recent geologic time by a stream or other body of running water. The Morrison and Summerville Formations underlie the alluvium at the North Continent site; the Entrada Sandstone aquifer underlies the Union Carbide site.

Ground water beneath the sites has been contaminated by past vanadium and uranium milling operations. Contaminants of potential concern at the North Continent site are uranium and selenium. Uranium is the most prevalent contaminant. Laboratory analyses of ground water samples indicate that samples from the majority of the alluvial wells contain uranium



*Figure 2. Union Carbide and North Continent Sites*

concentrations above the maximum concentration limit of 0.044 milligram per liter (mg/L); maximum uranium concentrations in the ground water samples are approximately 2 mg/L.

Selenium contamination is less prevalent; samples from only one well had concentrations exceeding the maximum concentration limit of 0.01 mg/L. The maximum concentration was less than 0.04 mg/L, which is below the EPA's primary drinking water standard of 0.05 mg/L for selenium. Bedrock beneath the alluvium at the North Continent site consists of interbedded mudstones, siltstones, and sandstones of the Morrison and Summerville Formations.

At the Union Carbide site, contaminants of potential concern are benzene, manganese, molybdenum, nitrate, radium-226, radium-228, selenium, toluene, and uranium. Manganese, molybdenum, nitrate, and selenium are major contaminants with concentrations 1 to 2 orders of magnitude above their respective maximum concentration limits and are widely distributed in the alluvial aquifer. Minor contaminants include benzene, radium-226, radium-228, toluene, and uranium, which are present in concentrations only

marginally exceeding their respective standards or which have been detected in samples from only a small portion of the alluvial aquifer. The Navajo Sandstone, which underlies the Entrada Sandstone, was not affected by site contaminants. The surface-water monitoring program at the Slick Rock sites has demonstrated that concentrations of site-related contaminants in the Dolores River do not pose an unacceptable risk to human health and the environment.

## **Land and Ground Water Use**

The North Continent site is not fenced and is currently used for livestock grazing. Most of the Union Carbide site is enclosed with a barbed wire fence. Land between the two sites is privately owned. Land use between the two sites includes irrigated alfalfa fields, livestock grazing, and gravel mining. Water used to irrigate the alfalfa is pumped from the Dolores River. There is no current use of alluvial ground water beneath the former processing facilities. Ground water used in the Slick Rock area is primarily supplied by the Navajo Sandstone aquifer.

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## Targeted Compliance Strategy

The targeted ground water compliance strategy for the North Continent site is natural flushing in conjunction with institutional controls and continued monitoring. Ground water modeling (i.e., computer simulations) predict that concentrations of uranium and selenium in the alluvial aquifer will decrease to levels below their respective maximum concentration limits within 100 years.

The targeted ground water compliance strategy for the Union Carbide site is natural flushing in conjunction with institutional controls and continued monitoring until the cleanup goals are achieved. Ground water modeling predicts that concentrations of molybdenum, nitrate, and uranium will decrease to levels below their respective maximum concentration limits and that concentrations of manganese will decrease to levels below background (the naturally occurring level of the constituent) in the alluvial aquifer within 100 years. Natural biological and geochemical processes are anticipated to reduce the levels of contamination for benzene, radium-226, radium-228, and toluene within 100 years.

Ground water modeling for selenium at the Union Carbide site predicts that the concentrations will not be reduced below the maximum concentration limit within 100 years. Therefore, DOE proposes setting an alternate concentration limit for selenium, using the risk-based human health drinking water benchmark of 0.18 mg/L. An alternate concentration limit may be applied to a hazardous constituent if it does not pose a substantial present or future risk to human health and the environment, as long as the contaminant concentration does not exceed the specified limit.

The contamination that was noted in samples from Entrada Sandstone wells located on the floodplain is considered to be a result of drilling and installing a well through the contaminated alluvial aquifer. The contamination is considered to be isolated to the vicinity around the well and not indicative of widespread aquifer contamination. Samples from these wells will be analyzed until concentrations are below the respective standards.

A site-specific monitoring program will be implemented at each site to verify protection of the Dolores River, evaluate the progress of natural flushing, and assess compliance with applicable standards and remedial goals.

## Institutional Controls

Institutional controls are "checks and balances" that effectively protect public health and the environment.

Typically, institutional controls depend on some legal order such as zoning ordinances and laws to ensure that protection is effective. EPA standards permit the use of institutional controls at sites where "passive remediation" can occur through natural flushing of the aquifer within 100 years. Institutional controls may also be used to protect public health or the environment if at any time during the cleanup process DOE finds them necessary and appropriate.

For the UMTRA Ground Water Project, institutional controls would reduce exposure to or reduce health risks by (1) preventing inappropriate intrusion into contaminated ground water or (2) restricting access to or use of contaminated ground water for unacceptable purposes (domestic household use).

The EPA standards require that institutional controls

- Have a high degree of permanence.
- Protect public health and the environment.
- Satisfy beneficial uses of ground water.
- Are enforceable by administrative or judicial branches of government entities.
- Can be effectively maintained and verified.

EPA recognizes that a combination of controls may be needed to protect public health and safety. Key to identifying, implementing, and enforcing institutional controls is participation by local and state governments in the development process. While DOE is responsible for compliance with EPA standards at UMTRA Ground Water Project sites, its authority to implement and enforce institutional controls is limited. This is particularly true where ground water contamination from uranium processing may have moved beyond the mill-site to areas that are not within DOE jurisdiction.

The need for, and the duration of, institutional controls depends on the compliance strategy selected for a site, the type and level of risk to human health and the environment, and existing site conditions. Movement of contaminated ground water may require restrictions for an extended period of time. As risks decrease over time, so should the need for institutional controls. Therefore, to ensure protection of human health and the environment and to satisfy requirements for beneficial uses of the water, it is important that the effectiveness of institutional controls be verified and modified as necessary.

Institutional controls will be required at both sites during the natural flushing period to restrict access to the uppermost aquifer and to protect human health. A covenant to the respective property deeds is being proposed that would restrict access to the ground water in the uppermost aquifer for the 100-year time

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frame or until ground water compliance objectives have been met. Institutional controls will be selected using input from the landowners, in conjunction with local, state, and Federal Government agencies. The final institutional controls selected for the Slick Rock sites will need to be approved by the U.S. Nuclear Regulatory Commission.

## **Long-Term Surveillance and Maintenance**

Once the compliance strategy has been finalized, it is the responsibility of DOE to ensure that the selected compliance strategy continues to be protective of human health and the environment. Ground water sites become part of the Long-Term Surveillance and Maintenance (LTSM) Program administered by the DOE Grand Junction Office. The LTSM Program manages the sites according to a Long-Term Surveillance Plan prepared specifically for the Slick Rock sites.

## **Documents Available**

The following program documents are available on the DOE Grand Junction Office Internet website at <http://www.gjo.doe.gov/ugw>:

*UMTRA Ground Water Project, Environmental Assessment of Ground Water Compliance at the Slick Rock, Colorado, UMTRA Project Sites*, February 2003

*Finding of No Significant Impact, Ground Water Compliance at the Slick Rock, Colorado, UMTRA Project Sites*, March 2003

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